PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing:	
14 September 2000 (14.09.00)	
International application No.: PCT/NL00/00154	Applicant's or agent's file reference: BO 41865
International filing date: 08 March 2000 (08.03.00)	Priority date: 08 March 1999 (08.03.99)
Applicant: KUZNETSOV, Vladimir, Ivanovich et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

20 June 2000 (20.06.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the 7 JUN
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

JORRITSMA, R. .
NEDERLANDSCH OCTROOIBUREAU
Scheveningseweg 82
(P.O. Box 29720)
NL-2502 LS The Hague
PAYS-BAS

5-7-01
8-9-01

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Applicant's or agent's file reference BO 41865	Date of mailing *(day/month/year)* 05.06.2001
	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00154	08/03/2000	08/03/1999

Applicant
ASM INTERNATIONAL N.V. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Reddy, J Tel.+49 89 2399-2231

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
BO 41865		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00154	08/03/2000	08/03/1999
International Patent Classification (IPC) or national classification and IPC H01L21/00		
Applicant ASM INTERNATIONAL N.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20/06/2000	05.06.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Crampin, N Telephone No. +49 89 2399 2566

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00154

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-6	as originally filed				

Claims, No.:

1-12	as received on	15/05/2001	with letter of	14/05/2001	

Drawings, sheets:

1/2,2/2	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   ☐ the language of publication of the international application (under Rule 48.3(b)).
   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-12
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-12
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-12
	No:	Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Reference is made to the following documents:

D1: US-A-5 788 425
D2: US-A-5 108 513
D3: US-A-3 706 475

Re Item I

Basis of the report

1.1 There is no basis in the originally-filed application documents for the feature now in claim 1 that the gas flow is diverted in a direction substantially parallel to said planar surface. The original application document merely discloses that the gas flow is diverted to flow along the grooves, which is not equivalent to the statement presently in claim 1. Furthermore, the statement that the gas flow is "blown against said major surface of said object **in a direction perpendicular to said major surface**" defines a gas flow impinging against the major surface of the object in a direction perpendicular to said major surface. Such a feature also has no basis in the original application documents. Rather, the gas flow was originally disclosed as being injected into the compartment in a direction perpendicular to said major surface of said object.

Claim 1 has therefore been interpreted as defining a method in which the gas flow is diverted to flow along the grooves and in which the gas flow is injected into the compartment in a direction perpendicular to said major surface of said object.

1.2 The statement in claim 8 that the "grooves are substantially parallel to the at least one of said parts" also has no basis in the application documents as originally filed.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 The gas-injection hole/groove arrangement of the present application is neither disclosed in D1, which is considered to be the closest prior art in respect of claim

1, nor is it disclosed in D2, which is considered to be the closest prior art in respect of claim 6, nor is this arrangement rendered obvious by either of D1, D2 or a combination thereof. Furthermore, none of the further available prior art renders the claimed arrangement obvious, there being no rotation of an object in these further prior art documents.

The subject-matter of claims 1 and 6 therefore satisfies the requirements of Articles 33(2) and (3) PCT.

1.2 Claims 2-5 and 7-12 are dependent on claims 1 and 6 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.

2. The applicant's attention is however drawn to the objections raised in items I, VII, 1 and VIII. Possible amendments which overcome these objections, clearly defining the gas-injection hole/groove arrangement of the present application and correctly delimiting the respective independent claims from the prior art, are attached to this Report. In these attached amendments, claim 1 has been clarified in the light of the objections raised in item VIII below and correctly delimited with respect to D1, the closest prior art in respect to this claim (cf. item VII, 1 below). The feature objected to in item I above has been deleted. Claim 6, which is correctly delimited with respect to D2, the closest prior art in respect of this claim, has been clarified in the light of item VIII below. The feature objected to in item I above has been deleted.

Re Item VII

Certain defects in the international application

1. Although claim 1 is drafted in the two-part form the feature that the object is substantially rotating only is incorrectly placed in the characterising portion, as it is disclosed in document D1 in combination with the features placed in the preamble - cf. D1, figures 12 and 13 - (Rule 6.3(b) PCT).

2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

The description relating to D3 on page 1, lines 7-10 of the present application seems to be incorrect in that no rotational movement would appear to be given to the wafer in D3 (cf. in particular D3: column 4, lines 16-20, where the only reference to wafer rotation in this document is made).

Re Item VIII

Certain observations on the international application

1. The following claims lack clarity (Article 6 PCT):

1.1 Claim 1 lacks clarity in that the whereabouts of the grooves is undefined, rendering the scope of protection unclear. In order for this aspect of claim 1 to be clarified it is considered to be necessary to define the top and bottom parts (2, 3) of the compartment and the fact that the grooves (9, 19) are formed in the surface of one of the top and the bottom parts (compare with claim 6 where this feature is already included).

1.2 The statement that the gas flow is injected into the compartment in a direction perpendicular to said major surface of the object is inconsistent with the embodiment shown in figure 4 of the present application where the gas flow, on exiting the gas-introduction openings 14, 16, is immediately diverted to flow along the grooves 19, so that the gas flow will immediately acquire a horizontal component on exiting the gas-introduction hole. It is furthermore questionable whether the aforementioned statement is accurate in respect of the embodiment described with respect to figure 1 where the grooves 9 similarly redirect the gas flow as it exits the gas-introduction holes 4.

1.3 Claim 6 lacks clarity in that the "gas flow" referred to in line 7 of this claim has not been previously defined.

<1> = <said compartment including a horizontal top part (2) located above said object and a horizontal bottom part (3) located below said object>

Claims

1. Method for rotating a disc-shaped object (10), such as a wafer, floatingly supported in a substantially horizontal position, <->wherein along a major surface of said object a gas flow is guided, giving a rotation to said object, wherein said gas flow is given the rotation generating component being tangential to the periphery of said disc shaped object by a pattern of grooves (9,19) characterized in that <1>said object is received in a compartment being closed on all sides, said object being substantially rotating only, and in that <2>said gas flow is injected into the compartment <3>~~and blown against said major surface of said object in a direction perpendicular to said major surface~~, whereby (into said compartment) after injection said gas flow is diverted by said grooves in (along said grooves to impart rotation to said object,) a direction ~~substantially parallel to said planar surface~~, ~~and~~ along the other planar surface of said disc shaped object a further gas flow is directed.

(said method further characterized in that)

<2> = <at least one of said top and bottom parts includes said pattern of grooves (4,14,16), wherein>

2. Method according to claim 1, wherein rotation generating gas flow is introduced at the upper ~~planar~~ major surface of said disc shaped object and along the lower planar surface a further gas flow is directed for supporting said object.

3. Method according to claim 1 or 2, wherein said gas flow, giving rotation to said object, is controlled using a pattern of spiral grooves (9) wherein the origin of the spiral lies in the vicinity of the desired centre (11) of the wafer, and the end of the spiral lies in the vicinity of the periphery of said shaped object.

4. Method according to Claim 1 or 2, wherein the said gas flow, giving rotation to said object, is controlled using a pattern of grooves (9), which patterns of grooves comprises circle segments and each of said circle segments is provided with at least one gas-introduction ~~opening~~ hole (14,16), arranged in the vicinity of one end of said circle segments.

5. Method according to claim 4, wherein each of said circle segments, provided with at least one gas-introduction ~~opening~~ hole (14) arranged in the vicinity of one end of said circle segments, is provided with at least one gas-discharge ~~opening~~ hole (16) arranged in the vicinity of an opposing end of said circle segments.

<3> = <from gas-introduction holes (4,14,16) located in said part including said grooves and oriented perpendicular to the surface of said part including said grooves>

6. Reactor (1) for the floating, rotational treatment of semiconductor wafers, comprising a top part (2) and a bottom part (3), between which a chamber (12) ~~which~~ for accommodating the wafer is delimited, the said top part and bottom part being provided with gas-introduction holes (4,14,16) for ~~gas supply openings~~ discharging gas into said chamber, characterized in that said ~~openings~~ holes are oriented essentially perpendicular to the top part (2) and the bottom part (3), and that a pattern of grooves (9,19) is arranged in the surface of at least one of said parts, said pattern of grooves being designed to imparts to ~~the said~~ gas ~~flow~~ a component which is tangential to the periphery of ~~said~~ wafer, ~~and which grooves are substantially parallel to the at least one of said parts,~~ held within said chamber. <entering into said chamber from said gas-introduction holes a flow>

7. Reactor according to claim 6, wherein the said pattern of grooves comprises a pattern of spiral shaped grooves (9), wherein the origin of the said spiral lies in the vicinity of the desired centre (11) of the wafer (10) and the end of the said spiral lies in the vicinity of the desired periphery of the wafer.

8. Reactor according to claim 7 wherein in at least one of the said parts, including grooves in its surface, the gas-introduction holes ~~supply openings~~ (4) are arranged along a spiral line (8) wherein the origin of the said spiral lies in the vicinity of the desired centre (11) of the wafer (10) and the end of the said spiral lies in the vicinity of the desired periphery of the wafer.

9. Reactor according to claim 7 and 8 wherein the said gas-introduction holes ~~supply openings~~ (4) are arranged next to the said spiral grooves.

10. Reactor according to claims 7-9, wherein the said spiral grooves are designed so as to widen in the direction of flow.

11. Reactor according to claim 6 wherein the said pattern of grooves comprises circle segments (19) wherein each of said circle segments is provided with at least one gas-introduction ~~opening~~ hole, arranged in the vicinity of one end of said circle segments.

12. Reactor according to claim 11 wherein each of said circle segments, provided with at least one gas-introduction ~~opening~~ hole arranged in the vicinity of one end of said circle segments, is provided with at least one gas-discharge ~~opening~~ hole arranged in the vicinity of an opposing end of said circle segments.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
BO 41865		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/NL 00/ 00154	08/03/2000	08/03/1999
Applicant		
ASM INTERNATIONAL N.V. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 3

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00154

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 706 475 A (YAKUBOWSKI CARL) 19 December 1972 (1972-12-19) cited in the application the whole document	1,5,8,9, 15
A	US 5 788 425 A (SKOW LYNN R ET AL) 4 August 1998 (1998-08-04) figure 13	1
A	US 5 108 513 A (EIGNER LASZLO ET AL) 28 April 1992 (1992-04-28) the whole document	1-4,7
A	US 4 874 273 A (TOKISUE HIROMITSU ET AL) 17 October 1989 (1989-10-17) column 7, line 4 - line 62 column 8, line 65 -column 9, line 2; claims; figures 1,6,7,10,11	1,8,9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 2000	05/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Rieutort, A

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter[illegible]al Application No
PCT/NL 00/00154

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3706475 A	19-12-1972	DE 2213842 A	12-10-1972
		FR 2131976 A	17-11-1972
		GB 1326334 A	08-08-1973
		JP 52033393 B	27-08-1977
US 5788425 A	04-08-1998	AU 4654593 A	14-02-1994
		CN 1088177 A	22-06-1994
		DE 69306581 D	23-01-1997
		DE 69306581 T	05-06-1997
		EP 0650456 A	03-05-1995
		IL 106252 A	08-02-1998
		JP 8503680 T	23-04-1996
		WO 9402396 A	03-02-1994
US 5108513 A	28-04-1992	DE 3923405 A	24-01-1991
		DE 59002987 D	11-11-1993
		EP 0408021 A	16-01-1991
		JP 2022910 C	26-02-1996
		JP 3055836 A	11-03-1991
		JP 7044165 B	15-05-1995
		KR 9700007 B	04-01-1997
US 4874273 A	17-10-1989	JP 1833251 C	29-03-1994
		JP 5041527 B	23-06-1993
		JP 63225028 A	20-09-1988
		JP 63225026 A	20-09-1988

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
BO 41865		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00154	08/03/2000	08/03/1999
International Patent Classification (IPC) or national classification and IPC H01L21/00		
Applicant ASM INTERNATIONAL N.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20/06/2000	05.06.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Crampin, N Telephone No. +49 89 2399 2566

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00154

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-6	as originally filed				

Claims, No.:

1-12	as received on	15/05/2001	with letter of	14/05/2001	

Drawings, sheets:

1/2,2/2	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   ☐ the language of publication of the international application (under Rule 48.3(b)).
   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Reference is made to the following documents:

D1: US-A-5 788 425
D2: US-A-5 108 513
D3: US-A-3 706 475

Re Item I

Basis of the report

1.1 There is no basis in the originally-filed application documents for the feature now in claim 1 that the gas flow is diverted in a direction substantially parallel to said planar surface. The original application document merely discloses that the gas flow is diverted to flow along the grooves, which is not equivalent to the statement presently in claim 1. Furthermore, the statement that the gas flow is "blown against said major surface of said object **in a direction perpendicular to said major surface**" defines a gas flow impinging against the major surface of the object in a direction perpendicular to said major surface. Such a feature also has no basis in the original application documents. Rather, the gas flow was originally disclosed as being injected into the compartment in a direction perpendicular to said major surface of said object.

Claim 1 has therefore been interpreted as defining a method in which the gas flow is diverted to flow along the grooves and in which the gas flow is injected into the compartment in a direction perpendicular to said major surface of said object.

1.2 The statement in claim 8 that the "grooves are substantially parallel to the at least one of said parts" also has no basis in the application documents as originally filed.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 The gas-injection hole/groove arrangement of the present application is neither disclosed in D1, which is considered to be the closest prior art in respect of claim

1, nor is it disclosed in D2, which is considered to be the closest prior art in respect of claim 6, nor is this arrangement rendered obvious by either of D1, D2 or a combination thereof. Furthermore, none of the further available prior art renders the claimed arrangement obvious, there being no rotation of an object in these further prior art documents.

The subject-matter of claims 1 and 6 therefore satisfies the requirements of Articles 33(2) and (3) PCT.

1.2 Claims 2-5 and 7-12 are dependent on claims 1 and 6 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.

2. The applicant's attention is however drawn to the objections raised in items I, VII, 1 and VIII. Possible amendments which overcome these objections, clearly defining the gas-injection hole/groove arrangement of the present application and correctly delimiting the respective independent claims from the prior art, are attached to this Report. In these attached amendments, claim 1 has been clarified in the light of the objections raised in item VIII below and correctly delimited with respect to D1, the closest prior art in respect to this claim (cf. item VII, 1 below). The feature objected to in item I above has been deleted. Claim 6, which is correctly delimited with respect to D2, the closest prior art in respect of this claim, has been clarified in the light of item VIII below. The feature objected to in item I above has been deleted.

Re Item VII

Certain defects in the international application

1. Although claim 1 is drafted in the two-part form the feature that the object is substantially rotating only is incorrectly placed in the characterising portion, as it is disclosed in document D1 in combination with the features placed in the preamble - cf. D1, figures 12 and 13 - (Rule 6.3(b) PCT).

2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

The description relating to D3 on page 1, lines 7-10 of the present application seems to be incorrect in that no rotational movement would appear to be given to the wafer in D3 (cf. in particular D3: column 4, lines 16-20, where the only reference to wafer rotation in this document is made).

Re Item VIII

Certain observations on the international application

1. The following claims lack clarity (Article 6 PCT):

1.1 Claim 1 lacks clarity in that the whereabouts of the grooves is undefined, rendering the scope of protection unclear. In order for this aspect of claim 1 to be clarified it is considered to be necessary to define the top and bottom parts (2, 3) of the compartment and the fact that the grooves (9, 19) are formed in the surface of one of the top and the bottom parts (compare with claim 6 where this feature is already included).

1.2 The statement that the gas flow is injected into the compartment in a direction perpendicular to said major surface of the object is inconsistent with the embodiment shown in figure 4 of the present application where the gas flow, on exiting the gas-introduction openings 14, 16, is immediately diverted to flow along the grooves 19, so that the gas flow will immediately acquire a horizontal component on exiting the gas-introduction hole. It is furthermore questionable whether the aforementioned statement is accurate in respect of the embodiment described with respect to figure 1 where the grooves 9 similarly redirect the gas flow as it exits the gas-introduction holes 4.

1.3 Claim 6 lacks clarity in that the "gas flow" referred to in line 7 of this claim has not been previously defined.

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<1> = <said compartment including a horizontal top part (2) located above said object and a horizontal bottom part (3) located below said object>

Claims

1. Method for rotating a disc-shaped object (10), such as a wafer, floatingly supported in a substantially horizontal position, <->wherein along a major surface of said object a gas flow is guided, giving a rotation to said object, wherein said gas flow is given the rotation generating component being tangential to the periphery of said disc shaped object by a pattern of grooves (9,19), characterized in that said object is received in a compartment being closed on all sides <1>, said object being substantially rotating only, and in that <2> said gas flow is injected into the compartment <3> ~~and blown against said major surface of said object in a direction perpendicular to said major surface~~, whereby (into said compartment) after injection said gas flow is diverted by said grooves in a direction (to) (along said grooves to impart rotation to said object,) ~~substantially parallel to said planar surface~~, said method further characterized in that ~~and~~ along the other planar surface of said disc shaped object a further gas flow is directed.

<2> = <at least one of said top and bottom parts includes said pattern of grooves (4,14,16), wherein>

2. Method according to claim 1, wherein rotation generating gas flow is introduced at the upper ~~planar~~ major surface of said disc shaped object and along the lower planar surface the further gas flow is directed for supporting said object.

3. Method according to claim 1 or 2, wherein said gas flow, giving rotation to said object, is controlled using a pattern of spiral grooves (9) wherein the origin of the spiral lies in the vicinity of the desired centre (11) of the wafer, and the end of the spiral lies in the vicinity of the periphery of said shaped object.

4. Method according to Claim 1 or 2, wherein the said gas flow, giving rotation to said object, is controlled using a pattern of grooves (9), which patterns of grooves comprises circle segments and each of said circle segments is provided with at least one gas-introduction ~~opening~~ hole (14,16), arranged in the vicinity of one end of said circle segments.

5. Method according to claim 4, wherein each of said circle segments, provided with at least one gas-introduction ~~opening~~ hole (14) arranged in the vicinity of one end of said circle segments, is provided with at least one gas-discharge ~~opening~~ hole (16) arranged in the vicinity of an opposing end of said circle segments.

<3> = <from gas-introduction holes (4,14,16) located in said part including said grooves and oriented perpendicular to the surface of said part including said grooves>

6. Reactor (1) for the floating, rotational treatment of semiconductor wafers, comprising a top part (2) and a bottom part (3), between which a chamber (12) ~~which~~ for accommodating a wafer is delimited, the said top part and bottom part being provided with gas-introduction holes (4,14,16) for ~~gas supply openings~~ discharging gas into said chamber, characterized in that said ~~openings~~ holes are oriented essentially perpendicular to the top part (2) and the bottom part (3), and that a pattern of grooves (9,19) is arranged in the surface of at least one of said parts, said pattern of grooves being designed to imparts to ~~the said~~ gas ~~flow~~ a component which is tangential to the periphery of ~~said~~ wafer, ~~and which grooves are substantially parallel to the at least one of said parts,~~ held within said chamber. <entering into said chamber from said gas-introduction holes a flow>

7. Reactor according to claim 6, wherein the said pattern of grooves comprises a pattern of spiral shaped grooves (9), wherein the origin of the said spiral lies in the vicinity of the desired centre (11) of the wafer (10) and the end of the said spiral lies in the vicinity of the desired periphery of the wafer.

8. Reactor according to claim 7 wherein in at least one of the said parts (including grooves in its surface), the ~~gas supply openings~~ gas-introduction holes (4) are arranged along a spiral line (8) wherein the origin of the said spiral lies in the vicinity of the desired centre (11) of the wafer (10) and the end of the said spiral lies in the vicinity of the desired periphery of the wafer.

9. Reactor according to claim 7 and 8 wherein the said ~~supply openings~~ gas-introduction holes (4) are arranged next to the said spiral grooves.

10. Reactor according to claims 7-9, wherein the said spiral grooves are designed so as to widen in the direction of flow.

11. Reactor according to claim 6 wherein the said pattern of grooves comprises circle segments (19) wherein each of said circle segments is provided with at least one gas-introduction ~~opening~~ hole, arranged in the vicinity of one end of said circle segments.

12. Reactor according to claim 11 wherein each of said circle segments, provided with at least one gas-introduction ~~opening~~ hole arranged in the vicinity of one end of said circle segments, is provided with at least one gas-discharge ~~opening~~ hole arranged in the vicinity of an opposing end of said circle segments.

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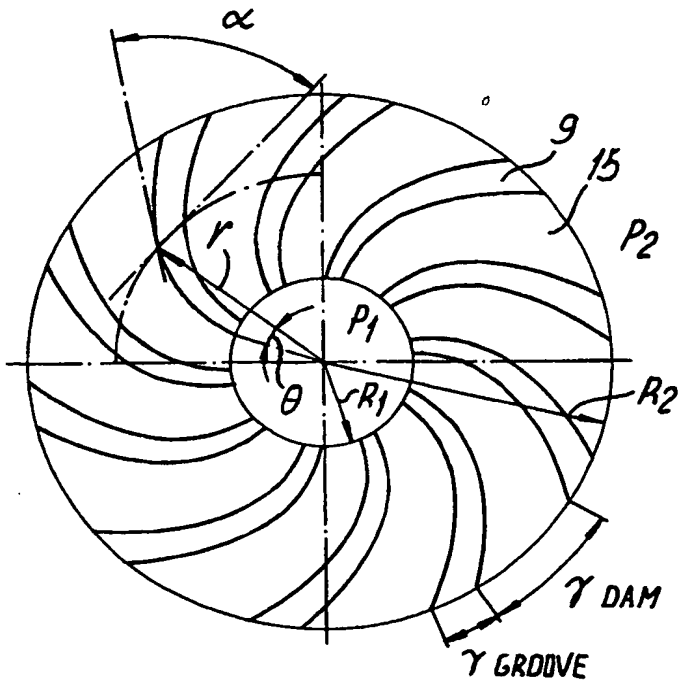
(54) Title: METHOD AND DEVICE FOR ROTATING A WAFER

(57) Abstract

Method and device for rotating a wafer which is arranged floating in a reactor. The wafer is treated in a reactor of this nature, and it is important for this treatment to be carried out as uniformly as possible. For this purpose, it is proposed to rotate the wafer by allowing the gas flow to emerge perpendicular to the surface of the wafer and then to impart to this gas a component which is tangential with respect to the wafer, thus generating rotation. This tangential component may be generated by the provision of grooves, which may be of spiral or circular design.



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Method and device for rotating a wafer

The present invention relates to a method for rotating a disc-shaped object, such as a wafer, wherein along a side of said object a gas flow is directed, giving a rotation to said object, wherein said gas flow is given the rotation generating component being tangential to said object by a pattern of grooves.

Such a method is known from US-A-3706475. In this specification a device is disclosed for transporting wafers. The device comprises an elongated trajectory and from the lower side gas is added in such a way that except from a transferring movement also a rotating movement is given to the wafer.

From US-A-393068 a method is known for rotating an object such as a wafer from semi conducting material placed in a reactor. During the treatment of a single wafer which is held floating in a reactor, it is important for a treatment of this nature to be carried out as uniformly as possible. For this purpose, it is proposed, in the prior art, to impart a rotational movement to the wafer. This rotational movement is imposed, according to the prior art, by having the gas-introduction openings opening out not perpendicular to the wafer surface, but rather having them end at an acute angle with respect to the wafer surface ("directional air jets"). As a result, a propulsive movement is imparted to the wafer.

However, drilling the gas-introduction openings in this way has proven to be particularly complicated while, in addition, the rotational speed which can be achieved is limited, owing to the fact that the gas which flows out very quickly loses its tangential flow component. Moreover, reactor walls of this nature are complicated to produce, since openings have to be drilled at an angle with respect to the wall.

The object of the present invention is to avoid these drawbacks while nevertheless maintaining the rotation of the wafer and making it possible, in a relatively inexpensive and simple manner, to impose a rotation of this nature on the wafer.

It is a further aim of the subject invention to accurately position the wafer to realise effective treatment thereof.

This aim is realised with the method as described above in that, said object is floatingly received in a compartment being closed on all sides, said object being substantially rotating only and in that along the other side of said object, a further gas flow is directed.

Through the presence of a groove pattern the gas flow is given a component of

movement extending tangentially to the wafer, i.e. gives a rotating movement to the wafer. Furthermore, the wafer is subjected from the other side to a further gas flow, so that this is accurately positioned in the reactor. Also the gas flows are controlled and provided such that the wafer substantially only rotates and does not execute a translating movement.

According to a preferred embodiment gas flow is blown in a direction substantially perpendicular to said object from a gas introduction opening in the reactor.

Surprisingly, it has been found that by providing a pattern of grooves it is possible to affect the direction of flow of the gas. The gas will preferably begin to flow in the direction of the groove, since this is the path of least resistance. The gas flow is guided in this way over the entire distance which the groove covers. If the direction of the groove contains a tangential component, a tangential flow component is also imparted to the gas. This tangential flow component imposes rotation on the wafer. Grooves of this nature can be produced relatively easily by milling. The pattern of grooves may have any desired shape. According to an advantageous design, the pattern of grooves is arranged in the shape of a spiral. In this case, the grooves are preferably arranged in such a manner that the spiral starts in the vicinity of the centre of the wafer and ends in the vicinity of the circumferential edge thereof. The desired rotational speed can be set by means of the shape of the spiral grooves. The total quantity of gas supplied to the wafer can therefore be selected independently of the desired rotational speed and can be set in such a manner that optimum axial and radial support and a uniform process result can be obtained. This can be achieved by adapting the shape of the spiral grooves. As a result, it is possible to work with comparatively small quantities of gases, as is desirable in order to maintain the uniformity inside the reactor.

This uniformity can be increased still further by also arranging the openings from which the gases emerge in a spiral pattern. This means that, according to a preferred embodiment, the openings extend essentially perpendicular to the surface of the wafer, but if these openings are joined by an imaginary line, the result is a spiral whose origin preferably also lies in the vicinity of the desired centre of the wafer and whose end lies in the vicinity of the circumferential edge thereof. During rotation, a point on the wafer does not always "see" the same openings arranged in a circle, which in the prior art causes an annular treatment pattern.

The combination of the rotation and the spiral pattern of gas-introduction openings results in a particularly uniform distribution of the treatment gases and a

particularly uniform treatment of the wafer surface.

Another possible design of the pattern of grooves consists in constructing this pattern from one or more circle segments. In this case, it is important for a gas-introduction opening to be situated in the vicinity of one of the ends of the groove. In this case too, the gas flow will preferably begin to flow in the direction of the groove. Since the direction of the groove is perfectly tangential, this method of rotational driving has proven particularly effective. Another advantage of this variant is that the rotational driving is virtually independent of the axial bearing of the wafer or, in other words, of the gas flow which keeps the wafer floating. For example, it is possible to increase or interrupt the gas flow for providing the rotational drive, while the gas flow for keeping the wafer floating is maintained at a constant level. As a result, the rotational speed of the wafer changes, while the other conditions in the reactor remain virtually unchanged. Positioning the grooves, which are arranged as circle segments, in the vicinity of the edge of the wafer maximises the drive moment and the efficiency of the rotational drive. Also arranging a gas-discharge opening in the vicinity of the other end of the groove further increases the efficiency of the rotational drive. The direction of rotation is reversed by reversing the direction of flow of the gas through the rotational drive groove.

According to a further preferred embodiment the gas flow imposing rotation to the wafer is, in the case that the wafer is in horizontal position in the reactor, introduced at the upper side of the wafer. I.e. rotational drive can be realised both from above, from below as well as from both sides.

The invention also relates to a reactor for the floating, rotational treatment of semiconductor wafers, comprising a top part and a bottom part, between which a chamber which accommodates the wafer is delimited, the said top part and bottom part being provided with gas-supply openings, the gas-introduction openings extending essentially perpendicular to the top part and/or bottom part and a pattern of grooves, which imparts to the said gas flow a component which is tangential with respect to the said object, being arranged in at least one of the said parts.

This reactor may be provided with the particular designs described above.

The invention will be explained in more detail below with reference to an exemplary embodiment which is illustrated in the drawing, in which:

Fig. 1 shows a diagrammatic, sectional view of a reactor which is provided with a wafer arranged floating therein;

Fig. 2 shows a plan view of the cross section taken on line II-II from Fig. 1;

Fig. 3 diagrammatically shows a spiral with a few important parameters, and

Fig. 4 shows a plan view of a variant of the pattern of grooves according to the invention.

In Fig. 1, a reactor is denoted overall by 1. This reactor is shown only in part and comprises a top part 2 and bottom part 3. In any desired way, which is not illustrated, a wafer 10 may be accommodated in the chamber or treatment space 12 delimited between these parts 2 and 3. The treatment gas for the wafer is introduced via gas-introduction openings 4 both above and below the wafer, and this wafer then adopts a floating position. Gas is discharged via discharge openings 7 which may be of any conceivable form and emerge at a circumferential channel 6 which is connected to a discharge line 5.

In order to impart rotation to the wafer, the top part, as can be seen from Figs. 1 and 2, is provided with a number of grooves 9. These grooves 9 are spiral-shaped, and the origin of the spiral lies in the vicinity of the aimed centre 11 of the wafer 10. The end of the spiral is situated in the vicinity of the circumferential edge of the wafer. Grooves 9 with the shape of a logarithmic spiral are chosen, as illustrated in Fig. 3. In this figure, the grooves are denoted by 9, while the raised part situated between the grooves, which is known as the dam, is denoted by 15; α indicates the groove angle, γ_{groove} indicates the groove width, while γ_{dam} indicates the dam width. θ represents the spiral angle co-ordinate. P1 is the pressure at the internal diameter and P2 is the pressure at the external diameter. The shape of a logarithmic spiral is described by:

$$r(\theta) = r_1 e^{\theta \tan \alpha}.$$

By way of example, the depth of the grooves is approximately 0.15 mm, and there are ten grooves, with a groove/dam ratio of 1:3 and a groove angle of 42°.

It has been found that a significant fraction of gas leaving the introduction openings 4 moves along these grooves 9 (least resistance), thus imposing rotation on the wafer.

Grooves of this nature may be formed in a subsequent stage, in contrast to the oblique drilled holes.

In order to further ensure the uniformity of the gas supply over the wafer surface, the introduction openings 4 are arranged along an imaginary spiral line 8. The origin of this spiral is likewise situated in the vicinity of the desired centre 11 of the wafer.

By varying the various parameters which determine the shape of the groove, it

is possible to control the rotational speed. Some of these factors include the depth of the groove, the groove angle, the groove/dam ratio, the number of grooves, etc. This can be influenced further by effectively positioning the introduction openings 4 with respect to the drive grooves 9.

Tests have shown that with a continuous flow of gas a stable rotation of the corresponding wafer is achieved after approximately 10 seconds starting from an initial situation. Naturally, this too is dependent on the conditions, and this time can be reduced considerably depending on the requirements imposed.

It will be understood that a corresponding design can be arranged on the underside. All this depends on the intended treatment. The speed at which the wafer is rotated is dependent on the process and preferably lies between 2 and 100 rpm.

Fig. 4 shows part of a variant of the invention. In this design, there are no spiral-shaped grooves, but rather a number of circle segments 19 which, in the design illustrated in Fig. 4, lie on the same circle. In the design illustrated in that figure, there are also gas-introduction openings 14 and 16.

As in the preceding designs, the openings extend essentially perpendicular to the plane of the drawing. If gas is introduced through openings 14, in the design in accordance with Fig. 4 the rotation will be to the left, while if gas is supplied from the openings 16, rotation will be to the right. The position of the rotational drive grooves is selected to be in the vicinity of the edge of the wafer, since this maximises the drive moment and the efficiency of the driving. The efficiency of the rotational driving can be increased still further by injecting gas in the vicinity of one end of the groove and discharging gas in the vicinity of the other end of the groove.

It should be understood that it is possible to use a number of circle segments of different radii.

Moreover, it is possible to make various gas-introduction openings, optionally in combination with gas-discharge openings, which are likewise situated in the vicinity of the circle segments. Moreover, in the latter case, the direction of flow between gas-introduction opening and gas-discharge opening can be periodically reversed, if desired.

Moreover, it will be understood from the two variant designs shown above, that other groove patterns are possible; all that is important for the invention is that the local depression caused by the grooves imparts a rotation-creating component to the gas which is blown in the perpendicular direction and may be diverted in the horizontal direction before

the wafer.

Although the invention is described above with reference to a preferred embodiment, variants which lie within the scope of the appended claims will immediately be obvious to people who are skilled in the art after they have read the above text. Although the invention is described with reference to moving a wafer in a reactor, it can equally well be used for moving any other object in any other type of chamber.

Claims

1. Method for rotating a disc-shaped object (10), such as a wafer, wherein along a side of said object a gas flow is guided, giving a rotation to said object, wherein said gas flow is given the rotation generating component being tangential to said object by a pattern of grooves, characterised in that, said object is floatingly received in a compartment being closed on all sides, said object being substantially rotating only and in that along the other side of said object, a further gas flow is directed.

2. Method according to claim 1, wherein said disc shaped object is provided substantially horizontal and said rotation generating gas flow is introduced at the upper side of said disc shaped object.

3. Method according to Claim 1 or 2, characterised in that the said at least one gas flow is controlled using a pattern of spiral grooves.

4. Method according to Claim 3, wherein the origin of the spiral lies in the vicinity of the desired centre (11) of the wafer, and the end of the spiral lies in the vicinity of the desired circumferential edge of the wafer.

5. Method according to Claim 1, wherein the said at least one gas flow is controlled using a pattern of grooves, which pattern of grooves comprises circle segments, and at least one gas-introduction opening is arranged in the vicinity of the said circle segments.

6. Method according to Claim 5, in wherein at least one gas-discharge opening is arranged in the vicinity of the said circle segments.

7. Method according to one of the preceding claims, wherein the wafer is rotated at 2-100 rpm.

8. Reactor (1) for the floating, rotational treatment of semiconductor wafers, comprising a top part (2) and a bottom part (3), between which a chamber (12) which accommodates the wafer is delimited, the said top part and bottom part being provided with gas-supply openings, characterised in that a pattern of grooves (9, 19) is arranged in at least one of the said parts, said pattern of grooves imparts to the said gas flow a component which is tangential with respect to the said object.

9. Reactor according to Claim 8, wherein the gas-introduction openings (4, 14, 16) extend essentially perpendicular to the top part (2) and/or bottom part (3).

10. Reactor according to Claim 8 or 9, wherein the said pattern of grooves comprises a pattern of spiral-shaped grooves (9).

11. Reactor according to Claim 10, wherein, in at least one of the said parts, the said gas-supply openings (4) are arranged along a spiral line (8).

12. Reactor according to Claim 10 or 11, wherein the origin of the said spiral lies in the vicinity of the desired centre (11) of the wafer (10), and the end of the said spiral lies in the vicinity of the desired circumferential edge of the wafer.

13. Reactor according to one of Claims 11 or 12, wherein the said supply openings (4) are arranged next to the said spiral grooves (9).

14. Reactor according to one of Claims 11-13, wherein the said spiral grooves are designed so as to widen in the direction of flow.

15. Reactor according to Claim 8, wherein the said pattern of grooves comprises circle segments (19), and at least one gas-introduction opening is arranged in the vicinity of the said circle segments.

16. Reactor according to Claim 15, wherein at least one gas-discharge opening is arranged in the vicinity of the said circle segments.

Fig-1

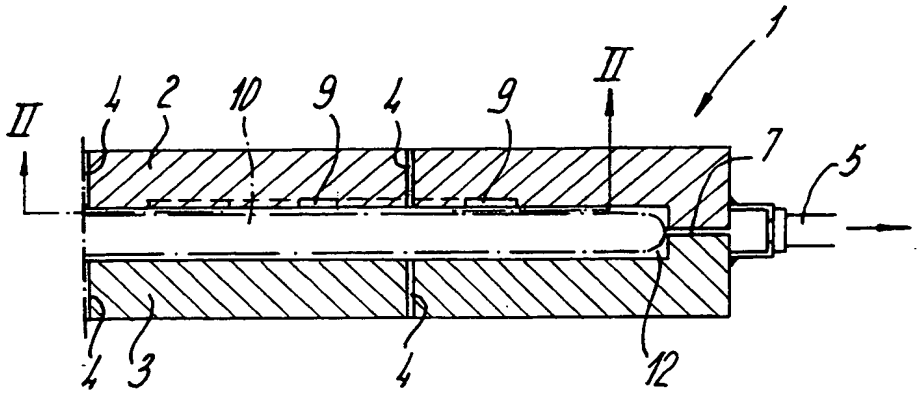


Fig-2

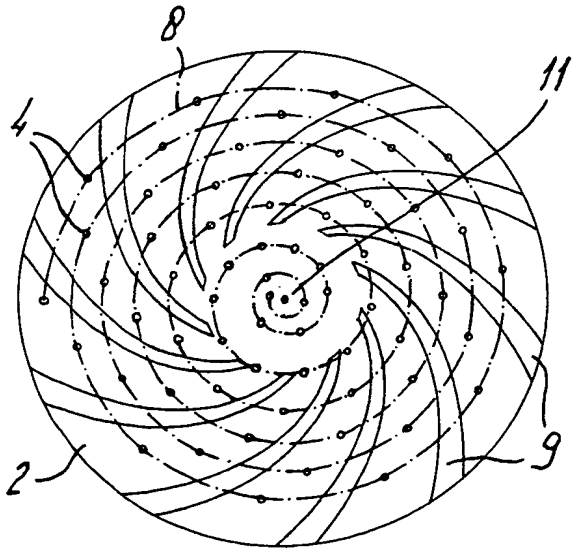


Fig-3

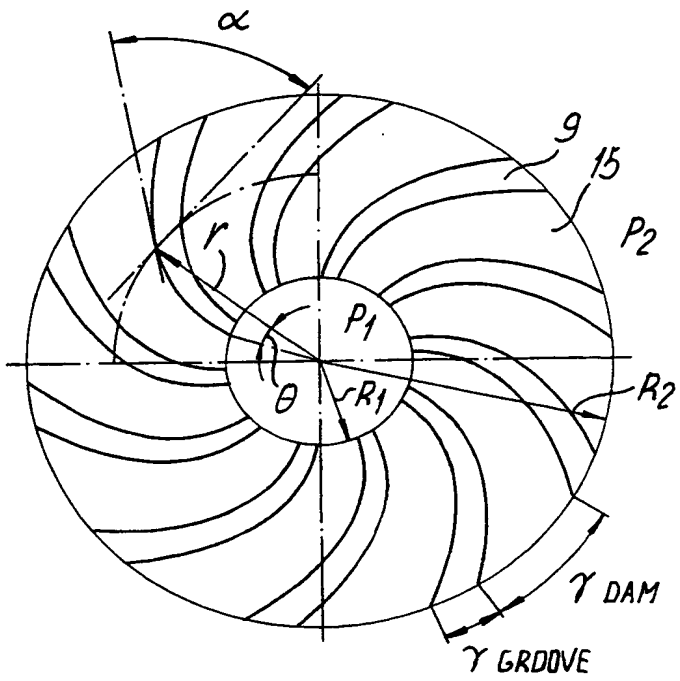
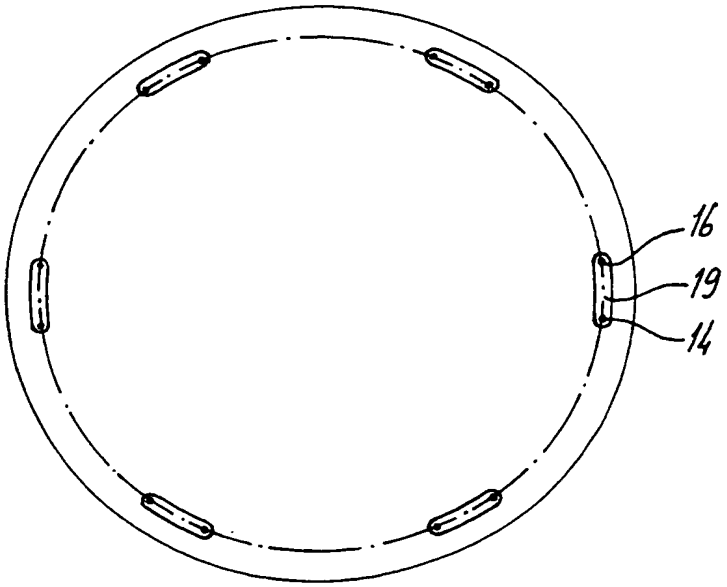


Fig-4



INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/NL 00/00154

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 706 475 A (YAKUBOWSKI CARL) 19 December 1972 (1972-12-19) cited in the application the whole document	1,5,8,9, 15
A	US 5 788 425 A (SKOW LYNN R ET AL) 4 August 1998 (1998-08-04) figure 13	1
A	US 5 108 513 A (EIGNER LASZLO ET AL) 28 April 1992 (1992-04-28) the whole document	1-4,7
A	US 4 874 273 A (TOKISUE HIROMITSU ET AL) 17 October 1989 (1989-10-17) column 7, line 4 - line 62 column 8, line 65 -column 9, line 2; claims; figures 1,6,7,10,11	1,8,9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 2000	05/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Rieutort, A

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INTERNATIONAL SEARCH REPORT

information on patent family members

Inte onal Application No
PCT/NL 00/00154

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